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A NEW SPECIES OF HELICOCEPHALUM

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(WITH PLATE 4)

The genus *Helicocephalum* was erected by Thaxter [1] in 1891 to make provision for a fungus that he found in a laboratory culture on carrion, and accordingly described under the appropriate binomial *H. sarcophilum*. In the brief discussion close resemblance to a large *Mortierella* or *Syncephalis* was pointed out, the similarity obviously applying more especially to the scattered distribution of the plant on the substratum, to the small diameter and aseptate or rarely septate condition of the vegetative hyphae, to the pronounced differentiation of the simple erect sporiferous hypha, and to the presence on the latter of rhizoid-like supporting basal attachments. Features distinguishing the fungus from any of the known genera of Mucoraceae were recognized in the character of the unusually large brown spores, as well as in their development through maturation of segments resulting from the insertion of septa at intervals in the helicoid distended terminal portion of the fertile hypha.

Although more than four decades have elapsed since the appearance of Thaxter's publication, the mycological literature of the intervening period would seem to offer no record of any encounter at first hand either with *Helicocephalum sarcophilum* or with any form sufficiently similar to be recognized as a congener. It may therefore not be unprofitable to set forth the main characteristics of such a congeneric form that made its appearance early in 1933 on rather old maize-meal agar plate cultures originally planted with decaying rootlets. On the mycelia of various species of *Pythium* that first extended themselves through the substratum had become superimposed a mixture of plant and animal life including an abundance of bacteria, nematodes of various species evidently feeding on the bacterial slime, several fungi preying on the nematodes,

[1] Thaxter, Roland. On certain new or peculiar North American Hyphomycetes. II. Bot. Gaz. **16**: 201–205. 1891.

amoebae of several types feeding on the bacteria as well as on the conidia of the nema-capturing fungi, and several species of minute phycomycetes preying on the smaller amoebae. The virtually complete degeneration of the *Pythium* mycelia had restored to the culture a degree of transparency little inferior to that of the medium originally; so that the delicate rangy hyphae of the fungus in question could be followed for long stretches with a water-immersion objective of high magnification. Optical conditions were therefore not unfavorable for uncovering possible mycelial relationships indicative of sarcophogy, opportunity for which the presence of fairly numerous dead nematodes and dead amoebae undergoing destruction by their fungous predators might be presumed to have supplied. However, even though occasionally somewhat denser branching could be made out in close proximity to a nematode freshly captured and killed, the visual evidence of sarcophagy was for the most part not especially striking. Yet the presumption for the fungus of a generally sarcophilous character comparable to that of Thaxter's species is perhaps not to be entirely dismissed, as some of the soluble substances in the dead microscopic animals could hardly have failed to diffuse into the agar substratum and thus become more widely available.

While in all phases of morphology and development the fungus under consideration shows close parallelism with *Helicocephalum sarcophilum,* its dimensions throughout are so much smaller as to leave no doubt that one is dealing with a distinct species. The vegetative hyphae are more delicate, measuring in diameter only slightly more than one-half of the 2.0 μ given by Thaxter. The fertile hypha which in Thaxter's fungus measures 1 mm. or more in height, here is usually only about one-half as tall. The basal diameter of the sporophore, which in the description of *H. sarcophilum* is given as 20 to 25 μ, is approximately only two-thirds as great in the present fungus, and an inferiority only slightly less pronounced is evident with respect to the apical diameter. In *H. sarcophilum* up to 21 spores are produced on one fertile hypha, whereas in the present form, rarely more than 10 are developed in a single head. Moreover the dimensions of the matured spores which in Thaxter's description are given as 55 $\times$ 30 μ (maximum 65 $\times$ 35 μ) are represented in the present form by values nearly a

third less. As in spite of the smaller dimensions relative to *H. sarcophilum,* the new fungus is yet one of impressive proportions, a specific term having reference rather to the small number of spores is proposed as tolerably appropriate.

Helicocephalum oligosporum sp. nov.

Sparsum; hyphis sterilibus 1.0–1.3 μ crassis, fertilibus cylindraceis, sursum tenuatis, 0.35–0.6 mm. altis, 13–16 μ crassis, sursum 5.5–7.0 μ crassis; conidiis in spira 5–10, elliptico-cylindraceis, utrinque obtuse rotundatis, maturitate brunneis, 32–45 × 20–25 μ, demum secendibus et in capitulum subglobosum viscosum cohaerentibus.

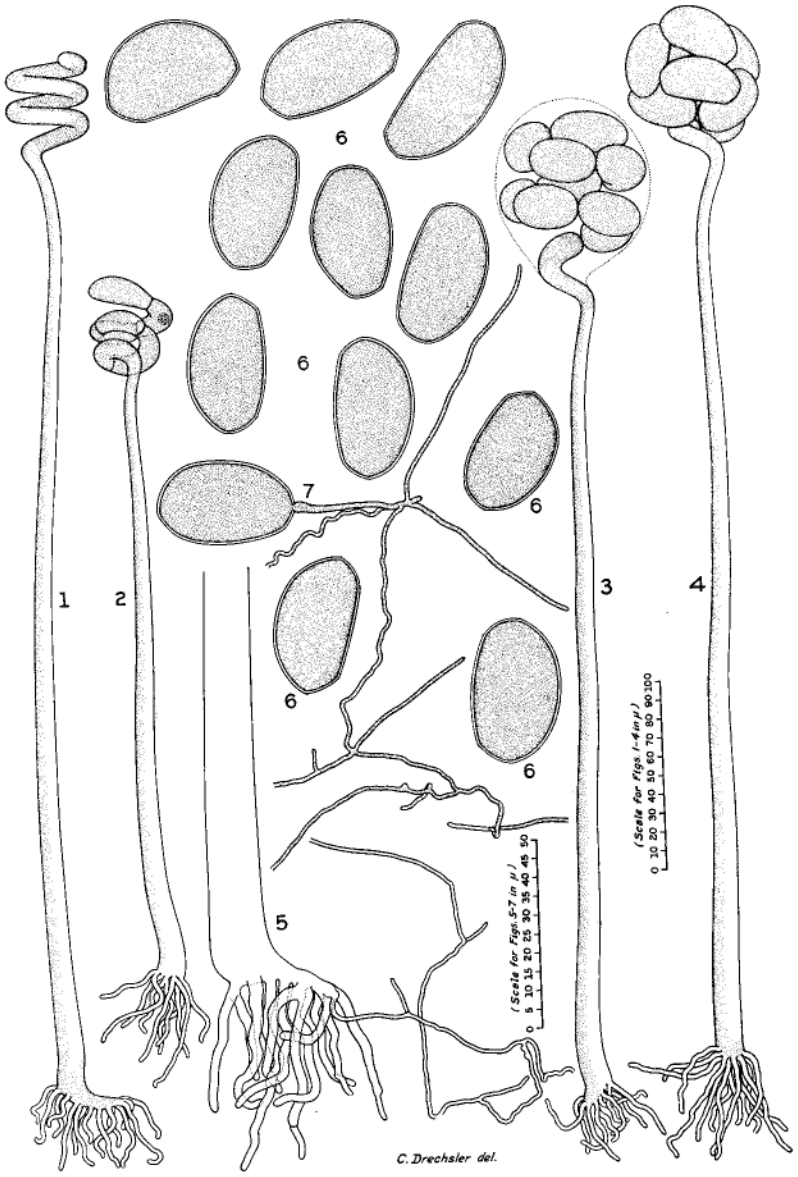
Sterile hyphae hyaline, creeping, rather sparsely branching, mostly 1.0 to 1.3 μ in diameter, devoid of septa except where living portions are contiguous to evacuated portions. Fertile hyphae sparsely scattered, hyaline, mostly 0.35 to 0.6 mm. in height, 13 to 16 μ in diameter at the base, where individually they are supported by rhizoids usually 10 to 20 in number and measuring 20 to 55 μ in length and 2 to 4 μ (average 2.7 μ) in diameter; tapering gradually upward to a diameter of 5.5 to 7.0 μ, then widening into a terminal portion abruptly coiled in usually 2 to 3 (mostly 2½) rather close helical dextrorse turns; the helicoid portion except for the proximal half turn, following insertion of septa at regular intervals, becoming converted at maturity into a chain of usually 5 to 10 spores. Spores brown, with finely granular contents, somewhat asymmetrically prolate ellipsoidal, obliquely truncate at either end (except terminal spore which is symmetrically rounded at distal end); provided with a wall mostly 0.5 to 1.0 μ in thickness; measuring 32 to 45 μ (average 38.7 μ) in length by 20 to 25 μ (average 22.5 μ) in diameter; separating and ultimately cohering in a rounded mass.

On laboratory culture prepared from decaying spinach (*Spinacia oleracea* Mill.) roots collected near Diamond Springs, Va., November 25, 1932.

Because of lack of evidence which might have referred *Helicocephalum sarcophilum* elsewhere, Thaxter prudently assigned the plant to the Hyphomycetes, adding, however, that it might eventually find a place among the Mucoraceae. In this connection the condition of the mycelium with respect to septation is deserving of some attention. The characterization of the sterile hyphae in the definition of the genus as "septate or rarely septate" would hardly encourage any very definite opinion concerning the taxo-

nomic affinities involved. Undoubtedly the difficulties attending the removal to microscopic mounts of vegetative mycelium from an opaque solid substratum in adequately extensive tracts must have been very considerable, and may have been only partly overcome. At any rate the rather meager representation of basal rhizoids in Plate XIX, Figure 1, accompanying the account suggests that a more than negligible degree of difficulty may have intervened even in the examination of these sturdier and more easily accessible structures. Such difficulty was fortunately not encountered in dealing with *H. oligosporum* in agar plate cultures, in which uninjured living vegetative filaments could be followed under high magnification to any lengths desired. The examinations thus facilitated revealed that whereas a septum was indeed present here and there, it always delimited a portion of filament filled with protoplasm from a contiguous portion of empty hyphal envelope. In no case were septa found inserted between adjacent masses of protoplasm within the vegetative thallus. In short the occurrence of septa was constantly associated with the evacuation or degeneration of protoplasmic contents in localized portions of originally continuous filaments, and was therefore thoroughly analogous to the occurrence of septa in the mycelium of the Phycomycetes generally.

The genus *Helicocephalum* may therefore with tolerable certainty be transferred to the Phycomycetes, apparently finding its most congenial place, as Thaxter well surmised, among the Mucoraceae. In this family, to be sure, it will occupy, hardly less than would have been the case in 1891, an isolated position; yet the isolation now becomes somewhat less conspicuous in view of the various other genera of curious morphology that have during the past four decades been definitely added here or are being assigned here with increasing confidence. As discovery of a sexual stage would be very useful in determining further the closer affinities of the genus, and since such a stage has not been found to occur hitherto in cultures of *H. oligosporum,* possibly because of a heterothallic condition, it is hoped that further strains of the same species may ultimately be found. Somewhat unfortunately the fungus has failed to grow in pure culture on any of the artificial media tried out so far, the spores failing to germinate and finally de-



HELICOCEPHALUM OLIGOSPORUM

generating when placed on sterilized agar substrata, though germinating fairly readily in the presence of contaminating bacteria and protozoa. For its conservation in living condition tube cultures representative of the same sort of biological mixture as that in which it originally made its appearance, have been successfully employed.

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EXPLANATION OF PLATE 4

Helicocephalum oligosporum. All figures drawn with the aid of the camera lucida, the magnification of those bearing numerals from 5 to 7 being exactly twice that of those numbered from 1 to 4. Fig. 1, Fertile hypha of approximately average definitive dimensions, showing basal rhizoids and terminal helicoid portion; ×250; 2, Fertile hypha of relatively small stature, after appearance of septa in the helicoid portion; ×250; 3, Fertile hypha after maturation of the brown spores, the original spiral arrangement of which is still maintained within the drop of extruded watery liquid; ×250; 4, Fertile hypha with ripe spores now disconnected but still cohering in a dry mass; ×250; 5, Basal portion of fertile hypha, showing connection with the mycelium from which it had origin, and relation to basal rhizoids; ×500; 6, Mature spores showing profile of each as viewed from along the axis of the spiral structure from which it originated; ×500; 7, Mature spore germinating with germ tube arising from truncate end; ×500.